

Constitutive modelling of Dhahran dune sand using cap model.

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Abstract

A three stress-invariant dependent cap model is considered in this work to study the behaviour of dune sand located in Dhahran, in the Eastern Province of Saudi Arabia. The model differs from the original cap model, primarily in its capability to characterize variation in strengths along compressive and extension stress paths.

In order to assess the applicability of this model, the local sand is tested using a modified conventional triaxial device. Existing triaxial apparatus was modified in the Research Workshop at the University to perform drained triaxial compression and triaxial extension tests under constant mean pressure condition. Besides these tests, hydrostatic compression test and conventional triaxial compression tests are also performed at different confining pressures. The test results are used to evaluate the eleven model parameters. These parameters are used to back-predict the stress-strain responses of triaxial tests and compared with the experimental observations. Results were found to be satisfactory.

The model is then implemented in a two dimensional finite element code to study the behavior of flexible and rigid footings on the surface of the Dhahran dune sand. Load-settlement curves and deformed meshes of the displaced soil mass are generated. It is found that the three stress invariant dependent cap model can effectively characterize the non-linear and inelastic response of the Dhahran dune sand. Results are also compared with the existing classical solutions.